

C L A I M S

1. Process for manufacturing a tyre compound comprising as a minimum a polymer base, a silica reinforcing filler, a silica-binding agent and further product and process additives, the said process comprising at least a first phase of processing the said ingredients to produce a blend and at least a second phase of processing the said ingredients to add a crosslinking system to the said blend and produce the said compound, at least the said first processing phase being carried out in a closed mixer comprising a container inside which rotates a pair of rotors, a hopper for introducing the said ingredients, a piston located above the said container which can move to and from the said pair of rotors to press the said ingredients between the rotors, and an outlet below the said container for discharge of the said blend, the said process being identified by at least two indirect process parameters, namely the power absorbed by the said pair of rotors and the temperature of the said blend, and by at least two direct process parameters, namely the number of rotations of the said pair of rotors and the pressure exerted by the said piston, the said process comprising the phases of:
- checking, during the manufacturing cycle, at least the values of the said two indirect process parameters, with an interval between two successive checks which is not greater than two minutes,
 - controlling the variable change of the said values by means of varying at least one of the said direct process parameters, so as to keep the values of each of the said indirect parameters within their respective range of predetermined values.
2. Process according to Claim 1, characterized in that the said interval is less than one second.

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3. Process according to Claim 1, characterized in that it is used for the manufacture of compounds comprising at least the following ingredients, in variable amounts, per one hundred parts by weight (phr) of polymer base, between the following limits:
- | | |
|-------------------------------|----------------------|
| Polymer base | 100 |
| Carbon black | 0-80 |
| Silica | 10-80 |
| Silica-binding agent | 4%-15% of the silica |
| Zinc oxide (ZnO) | 1-3 |
| Stearic acid | 0-3 |
| Anti-deteriorating agents | 1-3 |
| Plasticizing oil | 0-30 |
| Anti-ozone wax | 0.5-3 |
| Specific chemical ingredients | 0-15 |
4. Process according to Claim 3, characterized in that the said ranges of values are predetermined in relation to each specific compound to be produced.
5. Process according to Claim 4, characterized in that the method for predetermining the said ranges of values comprises at least the following phases:
- determining, in a specific reference compound, the average values and the related variability range for the said values for a plurality of properties both for the particular blend and for the compound, before and after vulcanization;
 - producing a sample compound using selected initial process parameters;
 - comparing the values of each of the said properties measured in the said sample compound with the corresponding values of the said reference compound;
 - modifying at least one of the said initial process parameters in relation to the values measured in the said sample compound which may be outside the said variability range;

- 5 e) repeating phases b), c) and d) until all the values for the said properties measured in the said sample compound are within the said predetermined ranges of values;
- 10 f) setting, as process parameters for each specific compound to be produced, the average values and the variability range of the said process parameters which generate values of the said properties measured in the said sample compound which are within the said predetermined ranges of values.
- 15 6. Process according to Claim 5, characterized in that the viscosity values and the percentage of silane reacted with silica are checked in the blend of the sample compound, free of crosslinking system.
- 20 7. Process according to Claim 5, characterized in that the viscosity values, the percentage of silane reacted with silica and the rheometric properties are checked in the sample compound before vulcanization.
- 25 8. Process according to Claim 5, characterized in that the density, hardness, modulus of elasticity, breaking load and elongation values of the sample compound are checked after vulcanization.
- 30 9. Process according to Claim 1, characterized in that the said first phase of processing the said ingredients comprises a phase of silicization followed by a phase of silanization, the said silicization phase being carried out at substantially increasing temperature, the said silanization phase being carried out at substantially constant temperature.
- 35 10. Process according to Claim 9, characterized in that the said silicization phase comprises at least three processing cycles carried out at different rotation speeds of the said rotors, with the said rotation speeds gradually decreasing.
11. Process according to Claim 9, characterized in that the said substantially increasing temperature in

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the said silicization phase is obtained by at least three peaks of supplied power.

12. Process according to Claim 11, characterized in that the said power peaks are obtained by lowering the piston towards the said pair of rotors.

13. Process according to Claim 9, characterized in that the said silanization is carried out with the said rotation speed of the said rotors substantially constant.

14. Process according to Claim 1, characterized in that the said indirect process parameters comprise the energy absorbed by the said pair of rotors.

15. Rubber compound for tyres, comprising at least the following ingredients, in variable amounts, per one hundred parts by weight (phr) of polymer base, between the following limits:

Polymer base	100
Carbon black	0-80
Silica	10-80
Silica-binding agent	4%-15% of the silica
Zinc oxide (ZnO)	1-3
Stearic acid	0-3
Anti-deteriorating agents	1-3
Plasticizing oil	0-30
Anti-ozone wax	0.5-3
Specific chemical ingredients	0-15

characterized in that it is manufactured by a process according to Claim 1.

16. Tyre for vehicle wheels which is provided with a tread band made of a rubber compound comprising a silica filler in an amount of between 40 and 80 parts by weight per 100 parts by weight of the polymer base and a silica-binding agent in an amount of between 4% and 15% of the silica filler, characterized in that the said rubber compound was produced by a process according to Claim 1.

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